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REDUCING COST OF BACKGROUNDING CALVES WITH EXTENDED FALL GRAZING OF ANNUALS

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FINAL REPORT
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EXECUTIVE SUMMARY

This project is focused on comparing weaned calf performance in background and feedlot systems and economic differences between three different management strategies. Study results will further complement information already available for Saskatchewan producers and provide new information for managing stocker animals and annual cereal crops.

With feed and yardage costs rising, reducing the cost of gain is crucial in today's operations in order to maintain profitability in the beef industry. In order to be both economically and environmentally sustainable, producers must take advantage of lower cost backgrounding systems, while at the same time ensuring animals reach targeted gains. Beef producers have evaluated extensive winter grazing systems in attempts to reduce costs associated with growing out weaned calves. Questions however, have been raised regarding the impact of these systems on calf performance during backgrounding and feedlot phases, crop yield and quality and system cost of gain.

This study was conducted to evaluate the effects of backgrounding systems such as swath grazing forage barley or foxtail millet compared to drylot pen feeding on calf performance, subsequent calf feedlot performance, crop yield, crop quality and cost of gain between systems. In the backgrounding phase, calves grazing swathed whole plant millet, gained 27 and 22% less compared to calves grazing swathed whole plant barley or fed mixed hay in a drylot pen. However, even though calves gained more per day grazing barley swaths than millet swaths, this growth was similar to gains on hay in drylot pens. Total body weight change was greatest on barley swath grazing and better than millet swath grazing. Calf gain on millet may have been restricted by the trend to lower dry matter intake and this may be related to the lower dry matter concentration of the millet swath relative to the barley swath or drylot hay-based ration.

In 2008-09, the millet swath-fed calves were similar in weight to the barley-swath-fed calves but lighter than the control hay-fed calves at the beginning of the feedlot trial. By the end of the finishing phase, all calves finished at similar weights among the three backgrounding systems. However the average daily gain of both barley- and millet-swath-graze calves was greater than the (control) hay-fed calves. This can be attributed to greater feed efficiency during the feedlot phase of the swath-grazed calves compared to the calves in the drylot or hay background system. These results from the finishing trials at the University of Saskatchewan feedlot indicate that millet-swath grazing will produce lighter calves that will exhibit compensatory gain and improved feed efficiency in the feedlot. The carcass quality and grade information indicate that these systems do not affect the market value of these finished animals.

Finally, in this study, backgrounding calves on barley swath grazing was 45% and 33% cheaper than drylot hay feeding in the two years, respectively. Costs to swath graze weaned calves on foxtail millet were intermediate to the other two backgrounding systems in both years. On average cost of gain in the field grazing backgrounding systems was 35 and 19% lower compared to the drylot cost of gain in 2007 and 2008, respectively.

INTRODUCTION

Traditionally, in western Canada, spring born calves are weaned in the fall and backgrounded in pens on stored forages during the winter and once a targeted weight is reached, transferred to the feedlot for the finishing period the following spring. With high labor, machinery and yardage costs, producers need to evaluate different options for back grounding programs and which can be adopted in terms of best return with reduced inputs. Furthermore, the program should provide adequate nutrients and be environmentally beneficial for the animals to grow at targeted gains during the fall and winter period. There has been limited studies in western Canada utilizing swathed field crops by weaned beef calves, however some work has been done in the United States (Volesky et al. 2002; Hitz and Russel, 1998; AAFRD 1998). By incorporating the use of low-cost field feeding systems into backgrounding programs, Saskatchewan beef producers can manage risk more effectively. The feeding strategy of utilizing field crops would allow producers the option of holding their calves for a more favorable early winter/spring market. In order for the beef industry to grow, particularly in post-BSE times, the industry must develop low-cost backgrounding practices for Saskatchewan born calves (Highmoor 2005).

Swathing the crop provides for a flexible grazing period and higher grazing efficiency compared to a standing crop. This is due to consolidation of the standing crop through swathing which can be easily apprehended by the animal (Aasen et al. 2004). Swath grazing leads to reduction in cost associated with manure hauling and provides a clean environment for exercise for the animals with fulfilling the nutrient requirement of a particular class of animal (McCaughey 1997).

Maximum seasonal production of many cool season perennial grasses was found to be approximately 60 % before the start of July in western Canada (Baron et al. (1993). This may create a shortfall of feed during winter, where the usual winter grazing period for beef cattle is around 200 days (Mathison et al. 1993). Cool season annual cereal crops can grow with various flexible dates and are also highly adapted to grow at lower temperature with maximum growth potential to fill the shortfall created by perennials (McCartney et al. 2008). It has been found that cows grazing swathed oats maintained their body condition and back fat similar to cows fed a typical winter ration of hay, straw and barley grain in the dry lot (AAFRD 1998). Aasen et al. (2004) found that swath grazing of barley provides sufficient protein and energy required for cows in mid pregnancy through lactation especially during fall and early winter. This study also reported very low degradation in quality as the grazing period progressed through winter. May et al. (2007) has reported that warm season annual grasses have been evaluated for hay and silage in western Canada since 1902, but advancement in the different winter grazing technique like swath grazing have led to the discovery of new cultivars of the warm season annual cereals and their potential for swath grazing. Further, McCaughey et al. (2002) mentioned that pilot studies conducted with swath grazing of millet (*Setaria italica*) resulted in production of large amounts of biomass and animals were able to easily access the feed through snow. In a comparative study of foxtail millet with barley, corn, and Sudan grass and Oat, May et al. (2007) illustrated

that foxtail millet (*cv. Golden German*) produced biomass similar to oats and barley under cold temperatures. With increase in temperature, foxtail millet (*cv. Golden German*) yields were much higher than barley and oats with crude protein content of 9.7% which is sufficient for meeting the requirement of second or third trimester pregnant beef cows.

Vast diversity exists in the plant species in different forage producing areas depending on the soil fertility, annual precipitation, and other environmental variables. To exploit this variation, various management techniques have been developed for grazing animals such as rotational grazing, supplementation and intensive stocking rates (Drouillard and Kuhl 1999). Consequently, it has been found that different management systems (which may include native range, crop residue, annual cereal crops or cool and warm season grasses) adopted for growing weaned animals has influenced feedlot performance and carcass characteristics (Capitan et al. 2004). This modest growth of the weaned animal might allow body weight gain to be put on during subsequent phases more economically (Baker 1975). Following the extension of a grazing period with modest growth, compensatory growth will and can occur when animals are fed a high grain diet for finishing (Capitan et al. 2004). Various experiments have been conducted for comparing the performance and carcass characteristics of animals reared extensively and intensively or where animals put on finishing just after weaning (Klopfenstein et al. 1999). However, limited information is available regarding the effect of extending the winter grazing of calves with swathed cool and warm season annuals on their backgrounding performance and no information is available for the subsequent effect of background system on feedlot performance and carcass characteristics. Therefore, this study was conducted with the following objectives:

1) To compare the performance of the fall weaned calves back grounded on (i) swathed forage barley (cv. *Ranger*) or (ii) swathed foxtail millet (cv. *Golden German*) compared to (iii) calves fed a grass-legume hay in a traditional dry lot system.

2) To compare forage quality, and availability from different annual forages throughout the grazing season.

3) To evaluate and compare calf feedlot performance and carcass characteristics during the feedlot finishing period.

4) To determine background cost of gain for all systems.

MATERIALS AND METHODS

Study Site

The back grounding trial was conducted at the Western Beef Development Center's (WBDC) Termuende Research Ranch located near Lanigan, Saskatchewan, Canada. This research facility is located in the east central area of the province on the Saskatchewan Plain and consists primarily of Chernozemic Black Oxbow soils. The feedlot finishing trial was conducted at University of Saskatchewan's Beef Research Unit located in Saskatoon, Saskatchewan.

Backgrounding Systems

The three backgrounding (BG) systems used in the study were swathed barley (BR), swathed millet (ML) compared to a traditional drylot (DL) pen feeding system. In June of each year, 8 hectares (ha) each of forage barley (cv. Ranger) and foxtail millet (cv. Golden German) were seeded at 108 kg per ha and fertilized with nitrogen at 56 kg per hectare. Crop areas were sprayed at 4-leaf stage with 2-4 D amine for broad-leaf weed control. In late August dry matter yield (DMY) was estimated by clipping replicate (n=25) 0.25 m^2 quadrat samples. The field was then further sub-divided into two, 4-ha replicate (n=2) paddocks for each backgrounding system using portable electric fence. In late August, the barley crop was swathed at mid dough stage and millet was swathed at 30% heading stage. High tensile electric wire fencing was used to indicate the perimeter of each paddock. During the study, swathed windrowed feed was allocated to each animal group on a 3-day feeding period using low tensile electric fence to minimize feed wastage. Water was provided in water troughs and portable wind breaks (10X6 m) were supplied in each paddock.

In the main pen facility and adjacent to the field crops, two pens surrounded by wooden slated fences with 30 % porosity were used to house the calves (20 calves/pen) for the traditional dry lot pen system. Animals were provided with ground grass-legume hay as feed in this system. To ensure targeted gains of 0.8 kg per day, calves in all treatments received an additional energy supplement in the form of a range pellet.

Experimental Animals

Each year 120 spring born, fall weaned Angus calves (60 steers; 60 heifers) were obtained from the main WBDC herd and were used for the study. All calves were implanted with RALGRO™ (36 mg Zeranol ; Schering Canada Inc.) at weaning in September of 2007 and 2008, respectively. Calves were vaccinated with Covexin™ - 8 (an 8- way modified live *Clostridial* vaccine; Schering- Plough Animal Health Canada Inc.) and STARVAC™ 4 plus (a modified live BVD, PI3, IBR, BRSV vaccine; Novartis Animal Health Canada Inc.) and also given 30 ml of Megamectin (ivermectin; Novartis Animal Health Canada Inc.). The average weight at start of trial for calves was 233 and 221 kg in 2007-08 and 2008-09, respectively. Calves were stratified by body weight (BW) and sex, then randomly allocated to 1 of 3 replicated (n=2) BG systems. All calves were weighed on 2 consecutive days at start and end of the trial and every 21 days throughout the

course of trial. Calves were adapted for 15 days on swaths of barley and millet prior to their allocation to each background system.

Each replicate group of calves (n=20; 10 steers, 10 heifers) were confined in the 4 ha paddock and managed using electric fence to control access to feed. Drylot calves were housed in replicated pens at the Termuende Research Ranch facilities. All animals were cared for in accordance with the guidelines of the Canadian Council on Animal Care (1993). Back grounding trial during 2007-08 was managed from 19 October 2007 to 24 January 2008, while the 2008-09 trial was from 15 October 2008 to 15 January 2009.

Following the backgrounding trial, all calves were transported to the University of Saskatchewan Beef Cattle Research Unit for finishing. Upon entering the feedlot, calves were separated by sex from each replicates of each treatment and assigned to one of 12 pens with stocking density of 10 animals (steers or heifers) per pen. Each pen was considered as experimental unit. All calves were weighed for 2 consecutive days at the start and end and every 30 days throughout the finishing trial.

Ad- libitum feed was provided to calves in feedlot twice daily. A similar ration was fed to all calves with consisted of silage, barley grain, straw, oat hulls and a pelleted supplement. After every two weeks feed bunks were cleaned and orts present were weight to determine the feed intake per day for each pen. Individual ingredient samples were collected after every two weeks and kept frozen for further chemical analysis. Sub cutaneous fat depth and *longissimius dorsii* area of the live animal were measured every two weeks with ultrasound as described by the Bergen et al. (1997). An Aloka 500 V real time ultrasound machine fitted with a 17 cm linear array transducer (Aloka 500, corometrics medical systems, Wallingford CT) was used. All animals were slaughtered at XL Beef Inc. Moose Jaw, SK after reaching the end point of 12 mm back fat level. Hot carcass weight, quality grade , yield grade, l. dorsi area and marbling score data was collected by Canadian Beef Grading Agency Graders. Due to closure of the XL Beef Inc. slaughter plant at Moose Jaw, SK, in November 2008, second year carcass data of the study could not be recorded.

Estimating available crop yield

Forage yield was estimated in the fall of each year prior to the start of the grazing trial .Two methods were used to estimate the forge yield. In the first technique, forage biomass was measured directly using 0.25 m^2 quadrat samples (n=25) within each replicate paddock in standing before swathing. The second technique involved direct determination of available feed weight in each field system by randomly weighing 25, (3 x 10 m) sections of swath (8 east side, 9 mid-field , 8 west side) in each replicate paddock where feed was placed on a tarp, weighed and then placed back in the swath. Techniques used to determine the forage yield were those as described by Volesky et al. (2002).

Laboratory analysis:

Forage samples were collected from each BG system prior to start of test (SOT) and every 21 days throughout the trial to determine changes in feed quality. All forage

samples were placed in a forced air oven at 55°C for 72 h to obtain DM content. Samples were then ground to pass through a 1 mm screen using a Willey mill.

To predict the energy and protein balance in the ration before starting of grazing and during grazing , all forage samples collected for both 2007-08 and 2008-09at start and after every 21 days interval throughout the trial were sent to Norwest Labs, Lethbridge AB fo. quality analysis. This analyses included moisture (AOAC, method 935.29), neutral detergent fibre (NDF) (FAP, method 5.1) and acid detergent fibre (ADF) (AOAC, method 973.18). Crude protein (CP) was determined by the Leco method (AOAC method 990.03), and minerals by AOAC, method 985.01.

Forage yield and quality

Yield samples of the standing crop were taken in the fall of each year prior to swathing and grazing (Table 1). The lower dry matter yield of the millet was consistent in both years. The higher moisture content of millet could impact total daily nutrient intake of growing calves in the study to maintain targeted gains.

Table 1. Yield of annual crops in backgrounding trial.

Item	Moisture (%)	Yield (kg/ha; wet basis)	Yield (kg/ha; dry matter)
2007			
Barley (Ranger)	14.8	8066	6872
Millet (Golden German)	38.2	9076	5609
2008			
Barley (Ranger)	15.0	9877	8395
Millet (Golden German)	35.1	10015	6499

Table 2 indicates average nutritive value of forages fed or grazed in the backgrounding systems. Energy content of forages was 58.4, 52.3 and 51 % total digestible nutrients for barley, millet and hay, respectively (Table 2). Crude protein content of forages was 12.0, 13.6 and 8 % for barley, millet and hay, respectively (Table 2). Protein content was observed to be lower for drylot hay fed to calves in pens. Neutral and acid detergent fiber levels were greater for millet and mixed hay compared to barley forage(Table 2). Forage lignin concentration was 5.7, 5.9 and 8.8% for barley, millet and mixed hay, respectively. Finally, calcium levels were slightly greater for millet compared to barley or hay (Table 2).

Table. 2 Chemical composition of forages in back grounding systems

Item	Treatment		
	Barley	Millet	Grass-legume hay
DM (%)	74.75	60.45	84.00
CP (% DM)	11.95	13.60	8.1
TDN (% DM)	58.35	52.30	50.6
NDF (% DM)	56.94	64.92	72.96
ADF (% DM)	35.79	41.00	48.39
Lignin (% DM)	5.73	5.94	8.76
Ca (% DM)	0.33	0.51	0.39
P (% DM)	0.29	0.24	0.16
DE (Mcal/kg)	2.59	2.35	2.23

Table 3. Chemical composition of mineral & vitamin premix fed to calves (Feed Rite Ltd, Humboldt, SK, Canada)

Element	Concentration
Calcium	20.0 %
Phosphorus	10.0 %
Cobalt (mg/kg)	70
Iodine (mg/kg)	200
Copper (mg/kg)	3000
Manganese (mg/kg)	9000
Zinc (mg/kg)	10,000
Iron (mg/kg)	3,700
Fluorine (mg/kg)	1,000

Vitamin A (IU/kg)	1,000,000
Vitamin D (IU/kg)	150,000
Vitamin E (IU/kg)	1,000

Table 3 shows composition of 2:1 mineral fed to all treatment groups in backgrounding trial. Mineral and supplement were fed to field calves in portable bunk feeders. Table 4 shows the supplement composition fed to all study calves. To ensure targeted gains of 0.8 kg per day, calves in all treatments received an additional energy supplement in the form of a range pellet. The supplement pellet contained Rumensin for control of coccidiosis and any respiratory issues.

Table 4. Backgrounding pellet composition[1]

Ingredient	% of diet (as fed)
Wheat shorts	54.9
Ground barley	33.1
Canola meal	5.5
Vegetable oil	2.0
Calcium carbonate	1.5
Ground wheat	1.1
Molasses	1.0
Salt, micro premix	0.6
Potassium chloride, F.R.S.[2]	0.3
Chemical analysis	
CP, %	15.9
NEm, Mcal/kg	1.88
Neg, Mcal/kg	1.18

[1]Pellet formulation was consistent across years
[2]Includes Rumensin-200 at 0.033%

Statistical analysis

Statistical analysis was conducted using a two factor ANOVA of the Proc Mixed Model procedure of SAS (SAS Institute Inc., Cary, NC) with diet and sex as the factors.

Calf data on average daily gain (ADG), DMI, feed:gain ratio, gain:feed, hot carcass weight, dressing %, back fat, rib eye area, ruler yield, and grade fat and marbling score by grade class were analyzed. Each replicate group of calves was considered an experimental unit for a total of 24 experimental units over the two year study. Tukey's multiple range test was applied to determine which treatment means were different.

Differences were considered significant when P<0.05 and all differences were noted when P<0.10 (trends).

Environmental data

Daily minimum and maximum temperatures were obtained from Agriculture and Agri-Food Canada, as well as daily precipitation obtained from Environment Canada. These were then averaged in order to obtain average monthly temperatures, and precipitation (Appendix Tables A1 and A2).

RESULTS AND DISCUSSION

Swath grazing backgrounding systems:

Growing cattle have energy requirements for both maintenance and gain. Energy and protein requirements for a 225 kg growing calf are 11.0% crude protein and 62.0% TDN to achieve an estimated 0.8 kg per day gain. Calves will consume 3.5% of initial body weight on a high forage backgrounding diet over the feeding period. In this study, average supplementation level for all calves was 0.615% body weight.

Calves gained more per day on barley swath grazing than on millet swath (Table 5) and this ADG was similar to gain on hay in the drylot. Total body weight change was greatest on barley swath grazing and better than millet swath grazing (Table 5.) Calf gain on millet may have been restricted by the trend to lower DM intake (P=0.11) and this may be related to the lower DM concentration of the millet swath relative to the barley swath or drylot hay-based ration (Table 1).

Table 5. Effect of backgrounding system on calf performance (2007-08 and 2008-09)

	Treatment				
Item	Barley	Millet	Hay	SEM	P- value
Initial BW (kg)	217.7	218.1	218.3	3.44	0.99
Final BW (kg)	297.4	275.7	293.2	3.97	0.008
Average Daily Gain (kg)	0.84a	0.61b	0.79a	0.03	0.002
Body Weight Change (kg)	79.7a	57.5b	74.8a	2.85	0.0009
Estimated Dry matter intake (kg $h^{-1}d^{-1}$)	8.1	6.2	7.1	0.54	0.11

a-b Values in rows followed by different letters differ (P < 0.05)

Backgrounding trial length was from 19 October 2007 to 24 January 2008 in the first year and from 14 October 2008 to 15 January 2009 in the second year.

Feedlot finishing:

During the finishing phase in 2007-08, the millet-swath-fed calves started the feedlot trial at 28 kg lower weights than the barley-swath-fed calves and finished at 9 kg lighter weights at the end of the feedlot trial (Table 6). These calves showed compensatory gain with 0.09 kg per day better gain than the barley diet calves. A similar response was observed for calf feedlot performance in the 2008-09 trial (Table 7). The dry matter intake and feed efficiency ratios were similar among the diet treatments. Sex differences were evident in weights, ADG, days on feed, and DM intake where steers performed better than heifers except for days on feed (Table 6).

The diet treatment x sex interaction was not significant ($P>0.05$) for any of the feedlot performance parameters (Table 6).

Table 6. Effect of consuming barley swath, millet swath and hay during back grounding on performance of finishing calves in 2008

	Treatment					Sex				T x S
	Barley	Millet	Hay	SEM[z]	*P* value	H	S	SEM[y]	*P* value	*P* value
Start of the test weight (kg)	340.4[a]	312.1[c]	327.3[b]	2.53	0.01	318.1[b]	335.2[a]	2.06	0.001	0.43
End of the test weight (kg)	616.8	607.5	612.4	2.84	0.14	589.1[b]	635.4[a]	2.32	0.0001	0.69
Average daily gain (kg d^{-1})	1.69[b]	1.78[a]	1.71[b]	0.01	0.03	1.68[b]	1.78[a]	0.01	0.003	0.52
Days of feeding	163	166	166	2.61	0.45	162[b]	169[a]	1.5	0.01	0.54
Dry matter intake (kg)	11.54	11.66	11.61	0.09	0.73	11.31[b]	11.89[a]	0.08	0.002	0.65
Feed: Gain	6.82	6.55	6.76	0.10	0.24	6.74	6.68	0.08	0.63	0.49
Gain: Feed	0.146	0.152	0.147	0.002	0.20	0.148	0.149	0.001	0.66	0.48

[z]SEM=pooled standard error of mean between forages
[y]SEM = pooled standard error of mean between sexes

Table 7. Effect of consuming barley swath, millet swath and hay during back grounding on performance of finishing calves in 2009.

	Treatment					Sex			T x S	
	Barley	Millet	Hay	SEM[z]	*P* value	H	S	SEM[y]	*P* value	*P* value
Start of the test weight (kg)	331.9[ab]	325.3[b]	339.4[a]	2.27	0.01	331.8	332.6	1.86	0.78	0.98
End of the test weight (kg)	629.8	618.6	623.4	5.50	0.40	623.9	623.9	4.49	0.99	0.75
Average daily gain (kg d^{-1})	1.70[a]	1.73[a]	1.60[b]	0.02	0.02	1.68	1.67	0.01	0.73	0.93
Days of feeding	171	174	174	1.8	0.62	172	174	1.47	0.49	0.11
Dry matter intake (kg)	11.6	11.5	11.3	0.14	0.43	11.4	11.4	0.11	0.98	0.25
Feed: Gain	6.8[ab]	6.6[b]	7.1[a]	0.10	0.06	6.8	6.8	0.08	0.72	0.23
Gain: Feed	0.14[ab]	0.15[a]	0.14[b]	0.002	0.05	0.14	0.14	0.001	0.73	0.22

[z]SEM=pooled standard error of mean between forages
[y]SEM = pooled standard error of mean between sexes

In 2008-09, the millet swath-fed calves were similar in weight to the barley-swath-fed calves but lighter than the control hay-fed calves at the beginning of the finishing trial (Table 7). By the end of the trial, the calves finished at similar weights among the three treatments (Table 7). However the average daily gain of both barley- and millet-swath-fed calves was greater than the control hay-fed calves. This can be attributed to greater feed efficiency of the swath-grazed calves compared to the control.

Unlike the previous year, there were no differences (P>0.05) in these variables due to the sex of the calves. But there was no diet x sex interaction which is consistent with the previous year.

Carcass quality:

There was no significant difference among the diet treatments for carcass quality traits in 2007-08 (Table 8). There was a tendency for the millet-swath-fed calves to have lighter hot carcass weight (P=0.08). The steer carcasses were heavier than the heifer carcasses and the ruler yield was greater for steers but otherwise there were not sex differences in carcass quality traits. There was not significant interaction (P>0.05) between the diets and sex factors for carcass quality traits.

Table 8. Effect of consuming barley swath, millet swath and hay during back grounding on carcass characteristics of finishing calves in 2007-2008.

	Treatment					Sex				T x S
	Barley	Millet	Hay	SEM[z]	*P* value	H	S	SEM[y]	*P* value	*P* value
Hot carcass weight (kg)	359.5[a]	349.6[b]	357.0[ab]	8.23	0.08	341.8[b]	368.8[a]	2.16	0.0001	0.28
Dressing %	58.0	57.5	58.2	0.52	0.60	57.8	58	0.42	0.79	0.60
Back fat (mm)	11.5	11.9	12.2	0.28	0.30	12.2	11.5	0.22	0.07	0.28
Longissimus dorsi area(cm^2)	96.0	93.5	93.7	1.33	0.40	93.3	95.5	1.08	0.20	0.80
Ruler yield (%)	59.7	58.5	59.2	0.54	0.32	58.3[b]	60.0[a]	0.44	0.03	0.62
Grade fat (mm)	10.5	11.2	10.7	0.86	0.82	11.8	9.8	0.70	0.09	0.51
Marbling score (% of calves)										
AAA (small or >)	32.5	25.0	35.9	4.2	0.58	27.9	33.8	0.04	0.51	0.68
AA (slight)	60.0	62.5	53.8	4.5	0.73	60	57.6	0.04	0.80	0.73
A (Modest)	2.5	5.0	10.3	2.2	0.40	8.0	0.0	0.01	0.97	0.99
B2 (Moderate)	5.0	7.5	0.0	1.8	0.90	0.0	0.1	0.10	0.99	0.99

[z]SEM=pooled standard error of mean between forages
[y]SEM = pooled standard error of mean between sexes

Due to packing facility management changes in 2008 only backfat data was collected on carcasses. In 2008-09, there was no differences (P=0.59) among the diet treatments for backfat thickness but the heifers had more backfat than steers (Table 9). There was a significant diet x sex interaction (P=0.02) for backfat in this year.

Table 9. Effect of consuming barley swath, millet swath and hay during back grounding on carcass characteristics of finishing calves in 2008-2009.

	Treatment					Sex			T x S	
	Barley	Millet	Hay	SEM[z]	*P* value	H	S	SEM[y]	*P* value	*P* value
Back fat (mm)	11.7	11.2	11.7	0.38	0.59	12	11.1	0.31	0.10	0.02

These results from the finishing trials at the University of Saskatchewan feedlot indicate that millet-swath grazing will produce lighter calves that will exhibit compensatory gain and improved feed efficiency in the feedlot. The carcass quality and grade information indicate that these systems do not affect the market value of these finished animals.

ECONOMIC COMPARISON OF BACKGROUNDING SYSTEMS

Economic analysis of the backgrounding systems incorporated costs associated with crop production and costs associated with animal grazing. The analysis included costs related to feed production, labour, and equipment for each treatment (SMA 2007; 2008). More detailed costs are presented in Appendix Tables A3 and A4.

Table 10. Effect of consuming barley swath, millet swath and hay during back grounding on cost of gain in 2007-08 and in 2008-2009.

	Barley	Millet	Hay (Drylot)
		$/head/day	
2007-08	0.64	0.89	1.17
2008-09	0.75	1.07	1.12

In this study, backgrounding calves on barley swath grazing was 45% and 33% cheaper than drylot hay feeding in the two years, respectively. Costs to swath graze millet were intermediate to the other two backgrounding systems in both years. On average cost of gain in field grazing backgrounding systems was 35 and 19% lower compared to drylot pen cost of gain in 2007 and 2008, respectively.

IMPLICATIONS

This research has shown the benefits of managing weaned beef calves in winter swath grazing backgrounding systems. Gains on barley swath grazing and the lower cost of this system, due to reduced yardage and manure removal costs, shows that this system would be a cost-effective alternative to feeding calves in the drylot for the backgrounding phase. These calves would not be disadvantaged in the feedlot phase or at grading during harvest relative to ground hay-fed animals in a drylot pen. The millet-fed calves exhibited compensatory gain in the feedlot study and this was associated with greater feed efficiency. Further studies should be done to confirm the magnitude of this response and whether there is economic opportunity for the beef feeding industry to exploit such an alternative backgrounding system.

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PERSONNEL INVOLVED

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Dr Bart Lardner - Project Supervisor, Western Beef Development Centre; Department of Animal & Poultry Science

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WBDC Beef Economist, Western Beef Development Centre

PROJECT EXTENSION ACTIVITIES & PUBLICATIONS:

FIELD DAYS:

Project results presented to producers at WBDC Field Days:

- June 27, 2006
- June 26, 2007
- December 2, 2008
- December 11, 2009

- East Central Beef & Forage Seminar. 2007. January 2007, Yorkton SK.
- Livestock Appreciation Night. 2010. February 2010, Yorkton, SK.

ARTICLES PUBLISHED:

- *"Backgrounding Calves With Swath Grazing Has Potential"*. Canadian Farm Business Management Council web site. http://www.farmcentre.com/Features/ScienceInnovation/. November, 2009.
- *Thinking of Swath Grazing Your Calves.* Canadian Cattlemen. The Beef Magazine. May, 2009.

WBDC Fact Sheets Published:

- Backgrounding Calves on Annual Forages. December 2008.

CONFERENCES:

Research results were presented at the following meetings:

- 2010 Saskatchewan Beef Symposium, Saskatoon, SK. January 2010 (paper presentation)
- Joint American Society of Animal Science-Canadian Society of Animal Science Annual Conference, Denver, CO. July 2010 (paper presentation)

Statement of Expenditures

A final statement for the project is included. All expenditures were in compliance with ADF guidelines. This project is all but finalized with the exception of a thesis defence. Mr. Kumar is near completion of his M.Sc. thesis. He is due to defend in Summer 2010. A copy will be forwarded to Agriculture Development Fund, Agriculture Research Branch, Ministry of Agriculture at that time.

PROJECT EXPENDITURES:

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APPENDIX

Table A1. Minimum (Min) and maximum (Max) temperature (°C) for 2007 at the Western Beef Development Center Termuende Research Ranch, Lanigan, Saskatchewan

Month	Temperature (^{0}C)			Precipitation(mm)		
	Max	Min	Mean	Rain (mm)	Snow (cm)	Total (mm)
January	-8.5	-18.4	-13.5	0.0	1.01	1.01
February	-13.4	-22.7	-18.1	0.0	0.64	0.64
March	-0.5	-10.8	-5.6	0.0	0.55	0.55
April	9.0	-2.0	3.4	0.17	0.04	0.21
May	17.8	5.0	11.4	2.09	0.0	2.09
June	21.6	9.0	15.3	2.04	0.0	2.04
July	27.1	14.3	20.7	0.95	0.0	0.95
August	21.6	9.0	15.4	1.53	0.0	1.53
September	17.1	3.7	10.4	0.87	0.0	0.87
October	11.7	-1.3	5.2	0.36	0.0	0.36
November	7.3	-12.04	-2.37	0.0	0.33	0.33
December	-11.5	-21.9	-16.7	0.00	0.91	0.91

Table A2. Minimum (Min) and maximum (Max) temperature (°C) for 2008 at the Western Beef Development Center Termuende Research Ranch, Lanigan, Saskatchewan

Month	Temperature (^{0}C)			Precipitation(mm)		
	Max	Min	Mean	Rain (mm)	Snow (cm)	Total (mm)
January	-9.6	-20.6	-15.1	0.00	1.16	1.16
February	-11.2	-23.2	-17.3			
March	-0.2	-12.0	-6.1			
April	9.3	-3.8	2.7	0.45	0.61	1.07
May	18.1	0.9	9.5	0.39	0.0	0.39
June	21.4	7.7	2.4	.64	0.0	.64
July	23.6	10.8	17.2	1.20	0.0	1.20
August	25.1	9.5	17.3	0.44	0.0	0.44
September	18.9	3.6	11.3	0.36	0.0	0.36
October	12.1	-1.3	2.1	1.48	0.0	1.48
November	2.3	-8.2	-3.1	.36	.25	.61
December	-13.8	-24.7	-19.3	0.0	8.96	8.96

Table A3. Backgrounding system costs (2007-08).

	Drylot ($/hd/d)	Barley ($/hd/d)	Millet ($/hd/d)
A. Feed Costs			
Ground hay	0.33	-	-
Supplement	0.25	0.25	0.25
Mineral and salt	0.05	0.05	0.05
Barley swath	-	0.35	-
Millet swath	-	-	0.26
TOTAL Feed Costs	0.63	0.65	0.56
B. Other Direct Costs (bedding, veterinary)			
TOTAL Other Costs	0.16	0.08	0.08
C. Yardage Costs			
Machinery	0.77	0.37	0.36
Labour	0.15	0.10	0.08
Repairs	0.01	0.005	0.01
Depreciation	0.02	0.01	0.01
Manure Cleaning	0.04	-	-
TOTAL Yardage Costs	0.99	0.48	0.45
TOTAL COSTS (A+B+C)	1.78	1.21	1.09
TOTAL GAINS	1.53	1.91	1.23
COST OF GAIN	1.17	0.64	0.89

Table A4. Backgrounding system costs (2008-09).

	Drylot ($/hd/d)	Barley ($/hd/d)	Millet ($/hd/d)
A. Feed Costs			
Ground hay	0.55	-	-
Supplement	0.70	0.63	0.63
Mineral and salt	0.07	0.07	0.07
Barley swath	-	0.27	-
Millet swath	-	-	0.47
TOTAL Feed Costs	1.32	0.97	1.17
B. Other Direct Costs (bedding, veterinary)			
TOTAL Other Costs	0.11	0.09	0.09
C. Yardage Costs			
Machinery	0.48	0.23	0.23
Labour	0.20	0.09	0.09
Repairs	0.01	0.005	0.01
Depreciation	0.02	0.01	0.01
Manure Cleaning	0.04	-	-
TOTAL Yardage Costs	0.75	0.33	0.33
TOTAL COSTS (A+B+C)	2.18	1.39	1.59
TOTAL GAINS	1.96	1.85	1.49
COST OF GAIN	1.12	0.75	1.07